August 10, 2011

Irwin Kishner
Herman Kishner Trust
294 Convention Center Drive
Las Vegas, NV 89109

Maryland Square Shopping Center, LLC
c/o Tim Swickard
Dongell Lawrence Finney LLP
770 L St., Suite 950
Sacramento, CA 95814

Subject: **Draft Corrective Action Plan for Groundwater, Maryland Square Shopping Center**

Facility: Al Phillips the Cleaner (former)
3661 S. Maryland Parkway
Las Vegas, NV
Facility ID: H-000086

Dear Mr. Kishner and Mr. Swickard:

The Nevada Division of Environmental Protection (NDEP) has reviewed the draft Corrective Action Plan (CAP) for Groundwater, prepared by Tetra Tech on behalf of the Herman Kishner Trust (Trust) and Maryland Square Shopping Center, LLC. (MSSC), and received electronically by the NDEP on June 14, 2011, and in hard copy on June 20, 2011. The current draft is substantially improved and has addressed most of the NDEP's comments.

This letter and attachment provide the NDEP's comments on the draft CAP for groundwater. In developing these comments, the NDEP has considered input provided by other parties to the NDEP and, where determined appropriate by the NDEP, has included those concerns in this letter.

General Comments

One critical deficiency in the current CAP remains with the proposed methods for evaluating the vertical distribution of contaminants and lithologies in the proposed treatment areas. In order to concur with the CAP, the NDEP requires that this characterization include the collection of continuous core from several borings east and west of the mall, along with depth-discrete sampling of groundwater. The proposed Hydrasleeve sampling technology cannot provide the level of detail that is needed. The NDEP considers both the continuous coring and depth-discrete sampling of groundwater in the proposed treatment areas to be necessary and essential components of the CAP.

Purpose of the Corrective Action Report

The Corrective Action Report should provide and discuss the data collected during laboratory and field pilot testing, along with the results of the human health risk assessment. The information collected during the laboratory and field pilot tests should be used to evaluate and recommend the alternative that appears to provide the most effective and appropriate technology for cleanup of PCE-contaminated groundwater at the Site.

Specific Comments

Detailed specific comments to the CAP for Groundwater are provided in **Attachment 1** to this letter. The comments in Attachment 1 are supplied for the record and do not require a written response.

NDEP Requirements

Pending receipt of adequate response to NDEP's comments in this letter, the NDEP plans to concur with the CAP and provide approval for the work described in the CAP to proceed. NDEP requests response to the comments in this letter by **August 25, 2011**. The NDEP requires the following:

(1) Include a description of the number and approximate locations for continuous core borings. These cores should provide detailed lithologic profiles within the proposed treatment area(s).

(2) Collect depth-discrete samples of groundwater, using a sampling system that is more specific than the Hydrasleeve can afford. Although not a specific product endorsement by NDEP, see the multi-channel tubing system described by Solinst: http://www.solinst.com/Prod/Multilevel-System-Comparison.html

No revisions to the CAP are needed for the NDEP comments provided in **Attachment 1** (for the record), but these comments should be considered and addressed in the Corrective Action Report.

Per the Permanent Injunction (December 27, 2010), the **Corrective Action Report** (including the human health risk assessment) is due within **180 days** of an approved CAP for Groundwater. Requests for extensions to the due date must be provided in writing at least 2 weeks prior to the due date and include a rationale for extending the due date.

If you have any questions or require additional information regarding this letter, contact me by telephone at (775) 687-9496 or e-mail at msiders@ndep.nv.gov.

Sincerely,

Mary A. Siders

Mary A. Siders, Ph.D.
Bureau of Corrective Actions
Fax (775) 687-8335

Enclosures (1)
Attachment 1 – Specific Comments for the Record

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ATTACHMENT 1
Comments for the Record, no Written Response Necessary

A matter of general concern to the NDEP involves the existing descriptions of the "pros" and "cons" of the various remedial technologies discussed in the CAP for Groundwater. The NDEP's review found that the potential difficulties implementing ISCO and the sparge curtain had not been completely acknowledged. In addition, it appears there was insufficient research on extraction and treatment systems currently operating successfully at other sites in the Las Vegas Valley.

The NDEP notes that certain site characteristics (lithologic heterogeneity and high concentrations of total dissolved solids [TDS]) affect all of the potentially viable alternatives discussed in the CAP. For the record, the NDEP has summarized these concerns, which will need to be addressed in the Corrective Action Report after pilot test data are collected.

<u>In Situ Chemical Oxidation (ISCO)</u>

There are significant difficulties using ISCO as the primary remedy for such a large-scale plume hosted in heterogeneous geologic deposits (dominated by silty clay in the treatment area). The NDEP notes that distribution of the injectate is likely to be the main challenge of any in situ remedy involving substrate injection (IDEM 2009, NAVFAC 2010), but plume displacement is also an issue. Injections can displace the contaminated groundwater into previously "clean" areas. Occlusion of porosity is an additional concern for any induced change in redox conditions.

<u>Sparge Curtain: Air Sparging</u>

The CAP acknowledges the potential for groundwater mounding associated with the air sparging system; but should also discuss that lithologic heterogeneity of the shallow groundwater system could result in air flow through preferential pathways. There is unpredictability of air distribution, especially at sites with heterogeneous lithology, such as the Maryland Square site. Concomitant with the uncertainty of the path of injected air, the path of PCE vapors is also unpredictable. Higher flow rates improve air distribution; however, higher flow can also reduce the permeability to water flow as pores are filled with air. Battelle (2002) notes that "*as the permeability reduction increases, there will be a greater tendency for groundwater to flow around and under the treatment zone.*" With air channels developed, there is the potential for concentration rebound as fine-grained zones act as a secondary source of PCE. Field pilot tests, including tracer gas (helium and SF6) testing along with groundwater pressure measurements are needed to evaluate the potential effectiveness of this remedy. The NDEP understands that the potential for fugitive vapors will be investigated and evaluated during the pilot testing, and that this issue will be addressed and discussed in the Corrective Action Report.

<u>Extraction and Treatment ("Pump and Treat" [P&T])</u>

P&T systems are operating effectively at other large sites in the Las Vegas Valley, including at sites with concentrations of total dissolved solids (TDS) that are greater than those in the vicinity of the Maryland Square PCE Site. A P&T system upgradient of the neighborhood would function as a hydraulic barrier and as a treatment zone. Reinjection of treated water would minimize stagnation zones and serve to flush out contaminated groundwater from beneath the neighborhood. Infiltration trenches could be used to minimize spreading of the plume and to provide an additional means to put down a layer of clean water atop the contaminated groundwater (thereby reducing PCE concentrations at the water table). Finally, the extracted water would be easier to treat under controlled conditions aboveground, and there would be no unpredictable migration of PCE vapors or the PCE plume.

Research and evaluate other large-scale P&T systems operating in the Las Vegas Valley and determine successful operating conditions in this difficult environment.

Redox Manipulation: Reduction and In Situ Biostimulation (ISB)
Another characteristic of the shallow groundwater system poses a challenge for certain technologies; in particular, those that rely upon reductive dechlorination. PCE degrades under anaerobic conditions (optimal ORP for reductive dechlorination is approximately -220 to -240 mV); however, the shallow groundwater system at the Site is aerobic, with abundant electron acceptors (e.g., average concentration of sulfate at 1,700 milligrams per liter [mg/L]). This characteristic poses a major hurdle for all reductive technologies, including in situ bioremediation (ISB); although NDEP recognizes that reduction technologies are not recommended in the CAP.

Comments below in order of occurrence in the CAP for Groundwater; not in order of importance

1. Section 1.2, Site Background, states that golf course irrigation wells are located "*...at distances ranging from 3,500 to 5,600 ft east of the former APTC location.*" The NDEP was unable to confirm the existence of well PW-3 shown in the northeast corner of the golf course (see Figure 3). NDWR digital and hard copy files indicate only an abandoned boring (dry hole) drilled in the area. Well PW-2, along with the purported PW-3, on the golf course do not appear to lie within the boundaries of the Maryland Square PCE Plume, and records submitted to NDEP by the golf course show no detected PCE in samples from PW-2.

2. Section 1.2.2, Site History, bottom of page 3 to top of page 4, states that the "*golf course management has sampled Well PW-1 and has detected PCE...*" Please note that golf course irrigation Well PW-2 and one pond were also sampled, and no PCE was detected in these samples from these other locations (letter from laboratory to golf course, dated 2-28-1990; sent to NDEP 11-8-07; see administrative record on-line)

3. Section 3.1, second paragraph states that "*the width of the plume is estimated to be approximately 1,100 ft near Spencer Street.*" Figure 3 shows a width of about 800 feet along Spencer Street at the 5 µg/L contour. If the datum from boring T-2 is considered (130 µg/L, URS report dated March 24, 2008), the plume width based on the estimated 5 µg/L contour appears to be closer to 900 feet.

4. Section 3.1, third paragraph continues, stating that "*the plume likely only came within the* ***capture zone*** *of irrigation well PW-1 after 18 to 20 years of migration.*" Until the vertical gradients and the interaction between the shallow groundwater and the deep aquifer (well PW-1 is screened from about 550 to 750 feet bgs) are evaluated, it is misleading to refer to "a capture zone," which implies a hydraulic stress field throughout the deep and shallow zones. A video survey of the irrigation well may show a cracked or otherwise compromised casing and well seal that has allowed the contaminated shallow groundwater to enter the casing or well bore; this is not the same concept as a "capture zone." The evidence to date, based on seasonal changes in the water level in the shallow groundwater, **argues against** any sort of drawdown or "capture zone" created by the irrigation well.

NDEP comment 103 on the February 28, 2011 CAP for Groundwater discussed the video survey, and NDEP's recent letter on the IAWW Work Plan requested that investigation of well PW-1 be included as part of the IAWW field work. This work includes evaluation of vertical gradients near the golf course well, PW-1.

5. Section 4.0, page 13, first paragraph, states that "*The golf course operates three irrigation wells, PW-1, PW-2 and PW-3.*" The NDEP was unable to find a record of irrigation well PW-3 in the DWR database or in DWR's hard copy files. Furthermore, a figure included in a report by the golf course's environmental consultant showed only PW-1 and PW-2 irrigation wells. Please provide the well log, construction information, and exact location for purported well, PW-3.

6. Section 4.0, page 13, first paragraph, continues, stating that "*The golf course management has sampled well PW-1 and has detected PCE at concentrations ranging from 130 μg/L in 2002 to 4.9 μg/L in 2006; the PCE detections were reported to NDEP in a letter dated May 12, 2004. NDEP wrote a letter to DCI Management Group Ltd., the owner of APTC on February 27, 2007 informing them that their 2004 letter reporting a detection of PCE in golf course well PW-1 had been inadvertently filed in the case file for a different golf course, and this had delayed the NDEP's response (NDEP 2007).*"

This history is not quite correct:

- May 12, 2004. Letter from golf course counsel to NDEP, reporting that the samples collected from irrigation well PW-1 had shown detected concentrations of PCE, starting in 1990. This letter was mistakenly placed in the NDEP case file for a different golf course.
- In January, 2007, the misplaced letter was found and sent to the case officer for the Maryland Square PCE Site.
- February 2, 2007, the NDEP case officer sent a response to the May 12, 2004 letter to the golf course counsel.
- February 16, 2007, golf course counsel responded to NDEP's February 2 letter, and provided a map showing locations of the two golf course irrigation wells, PW-1 and PW-2.
- February 27, 2007, NDEP sent a letter to APTC (DCI) informing them of the data for golf course well, PW-1.

7. Section 7.2, page 25, Groundwater Extraction and Treatment. The current text states: *Soil samples collected from the Site indicate the sand intervals frequently contain appreciable silt or clay (as much as 30 to 40%). Hydraulic tests at the site and in nearby areas of the City of Las Vegas indicate hydraulic conductivities likely range from 0.8 to 20 ft/day or 6 to 150 gpd/ft2. Assuming saturated intervals of 25 ft and 20 ft of available drawdown, the yields of individual wells may range from 1 to 20 gpm, with sandy zones at the higher rates and silts at the lower rates.* ~~However, considering the numeroushydraulic barriers and limited unit thicknesses created~~

~~by the heterogeneous conditions, and superposition effects from the influence of adjacent extraction wells, steady state production rates can be expected to be significantly lower in the range of 0.2 to 8 gpm. The sand zones will likely be depleted relatively quickly, with the capture zone of the well field likely being dewatered. The use of injection wells to return treated water to the groundwater system can help minimize the potential negative effects of a remedial production well field. Although greater production rates can be achieved by installing the wells to depths of 50 to 60 ft bgs in the Las Vegas Wash Aquitard, such well construction may only lead to greater dewatering of the shallow groundwater system. The well system would likely operate intermittently. Saturated clays at the Site would likely dewater and may shrink.~~ Production tests should be conducted within several silt, sand and gravel units at the Site to evaluate whether pump and treat is a viable alternative for remediation of groundwater at the Site.

~~Furthermore,~~ Treatment by air stripping or GAC will generate a secondary waste stream, and high TDS concentrations in the treated ~~waste~~groundwater may require treatment prior to reinjection; however, preliminary discussions with BWPC suggest that the treated groundwater could be reinjected downgradient of the pumping wells without treatment for the naturally occurring concentrations of TDS. That is, water quality would not be degraded by reinjection of the treated groundwater. ~~discharge may present complications due to water quality standards. If TDS must be removed from treated water before surface discharge, disposal, or reinjection, costs will be high.~~

As with sparging and AS/SVE, installation and operation of a extraction system in the residential area might be considered a nuisance by residents due to the presence of work crews, noise, etc. ~~Despite these practical constraints,~~ However, extraction and treatment may also be effective as a hydraulic control; therefore, the technology was retained for further consideration.

Please strike the language as shown in red above. Research and provide information on some current P&T systems operating in the Valley. This information can then be used to craft less-speculative text.

Please update the text regarding reinjection of high TDS water back into the same plume.

8. Section 8.1, page 27. With regard to the "Time required to achieve the remediation standard," the text states that *"It should be noted that current knowledge of the site parameters and hydrologic and engineering judgment has been used to assume remediation timeframes for each of the alternatives."*

As noted earlier in the text, the **preliminary** remediation standard is taken as a concentration corresponding to the 10^{-6} risk level, as the "point of departure" per the EPA. In the case of residential indoor air, that value for PCE is currently given as 0.41 $\mu g/m^3$ (EPA, 2011). However, background contributions are also considered when making risk management decisions and, according to a recent study, the median value for background contributions of

PCE in residential indoor air is approximately 1.4 μg/m^3 with the 95th percentile of background at 4.1 μg/m^3 (MA DEP, 2008).

A recent presentation by the EPA (Dawson, 2010) stated that "*Although subject to the RL of the study, BTEX compounds, PCE, methylene chloride, chloroform and carbon tetrachloride are expected to nearly always be detected due to background sources.*" "*A number of VOCs have typical (median) background concentrations above the 10^{-6} risk level (benzene, carbon tetrachloride, chloroform, methylene chloride, PCE).*" EPA concluded that (1) *Residential indoor air typically contains a variety of VOCs from consumer products, building materials, and outdoor air*; (2) *These background VOCs typically may exceed screening levels (e.g., carbon tetrachloride, benzene, ethyl benzene, PCE)*; and (3) *Consideration of these background concentrations critical in vapor intrusion investigations.*

The issue of "background" will be considered when developing the final remediation standard for PCE in indoor air. The PCE concentration in groundwater that is needed to achieve the 10^{-4}, 10^{-5}, and 10^{-6} risk levels for indoor air should be calculated and provided in the human health risk assessment, which is to be included in the Corrective Action Report. The amount of time needed to achieve the corresponding concentrations of PCE in groundwater can then be estimated, and projected costs estimated accordingly. The risk assessment provided in the Corrective Action Report should also include an analysis of how PCE vapors in soil gas are expected to decrease as PCE concentrations in groundwater are reduced.

9. <u>Section 8.2.2</u> describes the use of ISCO (Alternative 2A), with injection areas in the western and eastern parking lots at the Boulevard Mall. The text refers the reader to Appendix B for assumptions made for this alternative. The NDEP did not see an estimate of the mass of dissolved-phase PCE; an estimate of this mass, along with natural oxidant demand (determined in pilot tests), is needed to determine the amount of oxidant needed. There is a footnote to Table B-2 stating that oxidant demand was based on "high sulfates at the site"; however, sulfate is an electron acceptor, not an electron donor.

10. <u>Section 8.2.2, page 32, first paragraph.</u> The text indicates that the concentration of contaminants in groundwater would decrease "*quickly with chemical treatment*." Laboratory tests show that, yes, oxidizing reagent can break down PCE; however, <u>effective distribution</u> of the oxidant in the lithologically heterogeneous deposits at the site will likely be one of the greatest challenges.

11. <u>Section 8.2.2, Alternative 2A: ISCO in Target Areas, etc</u>. The potential challenges of this technology have not been adequately addressed in the CAP. Evaluation of sites where persulfate was employed as the remedy have found **significant rebound** in contaminant concentrations within months of the treatment (NAVFAC, 2010). Additionally, daylighting of the injectate occurred, along with solution migration along preferential pathways. These potential difficulties were not discussed in the CAP.

    Other potential issues associated with ISCO include the following:

- Displacement of the contaminated groundwater and the potential for spreading the contamination into previously clean areas (i.e., enlargement of the plume).

- Reaction rate for persulfate follows second-order reaction kinetics*, meaning that the rate of the reaction is **dependent on the concentration** of persulfate. As noted in NAVFAC, 2010, although persulfate was detected three months after the injections, this residual persulfate co-existed with stable or increasing concentrations of chlorinated solvent (i.e., concentrations of persulfate were so low that release of solvent from secondary sources exceeded the rate of the oxidation reaction.)

- Geochemistry of the groundwater is affected by ISCO reagents, so baseline conditions should be well-established prior to injections.

- Reductions in contaminant concentrations are not likely to be uniform across the site, and results indicate that multiple rounds of injections are needed "*to reduce a site's level of contaminants.*" Also, "*the practicability of applying additional rounds of ISCO must be compared against the cost to implement an alternative treatment technology for achieved the site's final remediation goals.*" NAVFAC, 2010

- Recirculation, with above-ground treatment and reinjection of cleaned water, "*may be better suited at sites where* ***greater control over the destination of the reagents is required, such as sites near potential receptors...***" (NAVFAC, 2010). [Note: This is essentially "pump and treat."]

- Rebound due to influx of contaminated groundwater from upgradient portions of the plume.

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*The half-life (*hl*) of a reaction is the time period required to reduce the reactant to half of its original value. The half life of first order reaction is a constant, independent of the initial concentration. The rate constant and half-life has the relationship:

$$hl = \ln(2) / k$$
$$hl * k = \ln(2)$$

For 2nd order reactions, the half life depends on the initial concentration, $[A]_o$, and the rate constant k:

$$hl = 1 / (k\,[A]_o)$$
$$hl * k\,[A]_o = 1$$

Since the concentration is reduced to half of its original value at the end of its first half-life, the second half-life is twice as long as the first half life. Thus, a plot of [A] vs. t easily reveals the order of the reaction by tracking its half life.

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12. Section 8.2.5 Sparge Curtain. The CAP states that "*clean water would flow from the downgradient edge of the sparge curtain*" and that a reduction in the concentration of PCE would occur "*fairly quickly in the residential area.*" What is the projected or estimated removal efficiency of air sparging? Is air sparging alone expect to produce groundwater with concentrations of dissolved PCE less than 5 µg/L immediately downgradient of the curtain?

13. <u>Section 8.2.6, Extraction and Treatment</u>. The CAP states that "*Groundwater would be extracted from within the plume, treated to remove PCE, and then re-injected. Extraction and injection wells would be installed where possible and* ***would cover the entire plume****. An estimated 14 extraction wells and 15 injection wells would be needed. Two treatment systems (one located in the mall parking lot and the other on the golf course property) would be considered. Treated water would be delivered to injection wells surrounding the PCE plume. It is expected that* ***wells in residential areas*** *would be installed in right of ways. The wells would be screened in the top 20 ft of the shallow aquifer.*"

    The bolded text above seems to imply that wells would be installed across the neighborhood. NDEP comments provided on the February 28, 2011 version of the CAP stated that:

    > "*The NDEP envisioned a transect of pumping wells just upgradient of the residential neighborhood, with reinjection within the plume just downgradient of the extraction wells to: (1) help reduce stagnant zones; and (2) help flush out contaminated groundwater under the neighborhood.*
    >
    > *Re-injection of poor-quality water back into the same "aquifer" is acceptable to the NDEP BWPC, upon issuance of an UIC permit.*
    >
    > *This configuration of pumping wells would serve both as containment and remediation, and would prevent the greatest mass of PCE (currently west of and underneath the mall) from migrating into the residential neighborhood.*"

    A line of extraction wells installed perpendicular to the axis of the plume in the eastern parking lot at the Mall would capture the contaminated groundwater before it entered the neighborhood (containment). On-site treatment would remove contaminants from the groundwater, and a line of injection wells would inject clean water downgradient of the extraction wells, as noted in the NDEP's earlier comments.

    What configuration of wells is actually being proposed in the June 14 CAP? Please provide a figure showing the proposed configuration (in general; these locations will not be assumed to be identical to what is ultimately proposed).

14. <u>Section 8.2.6 of the CAP</u> continues, stating that, "*It was also assumed that extracted groundwater could be reinjected after treatment to remove PCE but without treatment to reduce TDS. Some or all treated water may also be discharged to the sewer or supplied for irrigation if these options are later found to be more cost-effective.*"

    As stated in the NDEP's comments on the previous version of the draft CAP, reinjection of the cleaned groundwater was presumed to help minimize "stagnant zones" and to more rapidly flush out contaminated groundwater currently underlying the neighborhood. Of course, injection wells would need to be located appropriately to minimize any lateral spreading of the plume.

15. Section 8.2.6, on page 41 states that "*Pumping tests, as well as bench-scale and pilot tests, would be required to determine the effectiveness of the alternative, aquifer characteristics, design criteria, and best suited water treatment techniques. These tests would also allow for refinement of costs. Given the geology at the Site, there will likely be localized dewatering of the formation at each extraction well. The sorbed PCE in the dewatered zone could recontaminate groundwater when pumping stops. To reduce the impact of this phenomenon, it is expected that pumping will be pulsed rather than continuous. This aquifer has exhibited slow recharge of groundwater, indicating low hydraulic conductivity, which may make this technology difficult to implement and lead to a long remedial timeframe. The remedial duration is calculated at more than 40 years based on basic equilibrium partitioning and required pore volume exchanges. However, it is expected that the actual remedial duration will be much longer because of aquifer material heterogeneity and the tendency for fine-grained materials to be cleaned up slowly. Groundwater modeling should be completed to determine well placement. These tests would also allow for refinement of costs.*

    The NDEP agrees with the concept of pulsed pumping, and again references papers such as Hoffman (1993) regarding a more dynamic approach to "pump and treat." The NDEP also notes that "heterogeneity of the geologic deposits" is a complicating factor in **all** remedies, as is rebound due to desorption from finer-grained materials. Therefore, the text is not specific to P&T remedial technology. The duration of remediation may be significantly less than 40 years if dynamic P&T and reinjection is applied at the site. (Also note an inconsistency: "30 years" is given as the duration later in this same section).

    The NDEP assumes that the projected duration to clean up the groundwater is based on attainment of the 5 µg/L MCL for PCE. Durations could also be estimated for other concentrations (e.g., 50 µg/L or 100 µg/L). Based on the results of the risk assessment (to be provided in the Corrective Action Report), the remediation standard for groundwater may be modified from the water quality standard of 5 µg/L to a concentration that is protective of residential indoor air at the concentration selected as the remediation standard for indoor air (the latter standard also is yet to be determined).

    Discharge or reinjection of treated groundwater may be problematic due to elevated concentrations of TDS in extracted groundwater. Residents may find the installation of wells and the piping system in the right of way in neighborhood to be a nuisance."

    This text could be revised per later communications regarding the reinjection of remediated water back into the same groundwater, and NDEP's earlier comments regarding the P&T system. The NDEP does ***not*** envision P&T system ***within*** the neighborhood.

16. The text on page 41 under "Overall Protection of Human Health" states that "*However, as noted, this is expected to take over 40 years.*" Again, this estimate appears based on traditional, unoptimized P&T and cleanup to the MCL for PCE. Smart P&T, including pulsed pumping, well-designed wells and reinjection to minimize stagnant zones and flush out contaminated

groundwater currently underlying the neighborhood, may significantly reduce the time to achieve a remediation standard that is protective of indoor air.

17. The first bullet on page 42 states that "*There would be a high level of drilling and trenching, which would disrupt surface activities in the area and would lead to physical hazards. The noise and construction during installation in the residential area may be considered a nuisance by residents.*"

    Again, the NDEP did not envision extraction and reinjection wells within the residential neighborhood. Rather, the wells and treatment system would be located in the parking lot at the Mall, upgradient of the neighborhood.

18. The third bullet on page 42 states that "*Environmental impacts would be minimal and would include potential increases to Site TDS if reinjection is used.*" The concern is "...potential increases in the concentration of TDS in shallow groundwater at, and downgradient of, the reinjection wells." See previous comments regarding TDS.

19. Page 42, under "Implementability." The first bullet states that "*The alternative is considered technically feasible. Well installation, treatment of PCE contaminated water, and groundwater and indoor air monitoring are fairly routine activities. Pilot and pump testing and subsequent groundwater modeling would be required to assess site-specific conditions and determine spacing of the extraction wells. Dewatering is likely. Hydrogeology between the existing monitoring wells is not well defined in the target area, and potential impermeable lenses in the aquifer may influence hydraulic capture. The high TDS may lead to precipitate formation and fouling of the extraction and treatment equipment, which can be costly. Problems with site access or drilling issues could impact the schedule.*"

    The NDEP notes that a properly designed P&T system that is properly operated and maintained is unlikely to have the operational problems stated in the above text from the CAP. There are P&T systems operating in the LV valley in areas with higher concentrations of TDS (e.g., 10,000 mg/L TDS). Choices such as using GAC in a "wet" system, rather than air stripping, can be used to minimize precipitation issues. Pulsed pumping and properly designed wells can minimize potential dewatering issues. Permitting issues can be worked out in advance, in terms of reinjection of treated water. The NDEP suggests that you research these other sites, which are permitted with either NPDES discharge of treated water or UIC re-injection of "conditioned" water with amendments (Tronox and AMPAC, respectively). Groundwater at the Tronox site runs about 7,000 - 12,000 umhos/cm EC (so roughly 4,000 - 7,000 ppm TDS) and groundwater at AMPAC runs about 1,500 - 3,000 ppm TDS. Both sites have high concentrations of sulfate.

20. Page 44, last paragraph. Text states that "*High sulfates may be problematic and require additional substrate; given sulfate concentrations at the Site, EHC is likely one of the few substrates that **will** be effective.*"

The NDEP notes that **high concentrations of sulfates** pose problems as electron acceptors and, when reduced, present sulfide toxicity issues for microbes. Also note that "*EHC is a substrate that* ***may*** *be effective.*" NDEP recognizes that this alternative in not recommended in the CAP.

21. Page 45, State Acceptance. The text states that "*While high sulfate and electron acceptor concentrations at the Site would require the addition of more EHC, this alternative may be viable in certain areas of the Site with favorable ORP values.*"

    The NDEP notes that the optimal range for complete reductive dechlorination is -220 to -240 mV, yet 29 of the 33 wells across the site have median ORP values > 100 mV. It is therefore unclear what areas of the site are believed to have "favorable ORP values."

22. Section 9.1, Page 49. The "most promising technologies" are listed as ISCO and the sparge curtain. The NDEP finds that P&T has not been adequately researched and that P&T may prove to be an effective technology that provides both containment and treatment, while avoiding the problems of (1) fugitive vapors (in the case of air sparging) and (2) pushing the plume into previously clean areas (in the case of injection of oxidant solution).

23. Section 9.2, Additional Testing, first bullet. The text states that "A*quifer characteristics such as hydraulic conductivity, transmissivity, and ion and mineral chemistry, is required to profile relevant subsurface features within the target areas.*" It is unclear what is meant by the terminology, "ion and mineral chemistry," and whether this is intended to relate to the chemistry of groundwater or the chemical composition and mineralogy of the soils (?)

Appendix B.
It is unclear how the volumes of reagent were estimated. Was the mass of PCE in the dissolved-phase plume estimated? What assumptions were used for such estimates? The footnote states "Oxidant demand based on high sulfates at site"... but sulfate is an electron acceptor not an electron donor.

Appendix C.
Appendix C, Pg. C-3, Section 3.1, Continuous coring and vertical discrete-depth groundwater sampling Modification required: Prior to installation of the proposed extraction and any injection wells, pilot boreholes using **continuous coring** should be advanced and **discrete-depth groundwater samples at 5 foot intervals** should be collected through the interval proposed for testing (i.e., water table to 60 feet) in at least two locations west of the main Boulevard Mall building and three locations east of the Boulevard Mall building. Alternatively, continuous coring with follow-up use of the continuous multichannel tubing (CMT) technology (used as presented in the TIMET work plan, which was sent to Tetra Tech by NDEP in late May, 2011) would be acceptable.

Available site information indicates that layers of different permeability likely control movement of shallow groundwater at the site. Therefore, it is critical to understand how PCE is distributed vertically within the shallow groundwater (in order to target appropriate intervals for pilot testing, monitoring, and remedy selection) and how PCE distribution is controlled by these different lithologic units. Use of Flovision borehole tool and evaluation of existing information from the PDB study by Converse are not sufficient for the area(s) targeted for remediation. The Flovision borehole tool provides information on potential for vertical movement of contaminants within individual wells, but it does not provide information on vertical distribution of contaminants within the natural formation that is the target of cleanup efforts. As noted by Converse in their April 28, 2010 report, pg. 8 "[it] *is likely that vertical movement of contaminants is in part controlled by stringers of more permeable material throughout the subsurface that are not readily identifiable while logging using certain methods*." If necessary, these methods can be used as supplemental techniques in areas targeted for additional plume definition (e.g., area east of Spencer St.).

<u>Appendix C, Section 4.0, Pilot Tests, Page C-5.</u> Sufficient monitoring wells must be installed and monitored to verify that targeted treatment zones for pilot tests do <u>not</u> overlap.

<u>Appendix C, Section 4.1, Pilot Tests, Page C-5</u>, second bullet. Clarify that this refers to saturated soil to be sampled.

<u>Appendix C., Section 4.2, Pages C-5 to C-8.</u>

- Under the Eh-pH conditions at the site, dissolved iron cannot be greater than 10 mg/L; solubility of ferric iron (i.e., dissolved ferric iron) is quite low (on the order of perhaps tens of *micrograms* per liter).
- The NDEP concurs with the concept of a helium (He) tracer test, and notes that a transient pressure transducer response test could also be conducted as part of the AS pilot testing.

<u>Appendix D, Comment 41, Page 20</u>. The NDEP could not confirm the presence of a third irrigation well on the golf course, despite examining NDWR's electronic database and hard-copy files. Please provide information to confirm the existence of a third well.

<u>Appendix D, Comment 52, Page 27</u>. Comment regarding examples of successful use of ISCO for PCE plumes in similar conditions (i.e., hosted in heterogeneous geologic deposits, aerobic) and of similar magnitude (i.e., similar size and concentrations). Please provide references (i.e., reports and data) for the one example listed (Tartan Textile Services).

<u>Appendix D, Comment 103, Page 56</u>. There is no response provided to NDEP's comment regarding video survey of the golf course well, PW-1 and investigation of vertical gradient in the vicinity of this well.

FIGURES

Please fade out photographs so that annotated material can be seen more clearly. This applies to Figures 1, 2, 3, 7, and 8... Figure 9 is already faded out somewhat (compare Figure 3 with Figure 9).

TABLES

<u>Table 8.2, page 48</u>. Under "current data..." for "extraction and treatment," the first bullet seems misplaced.

Pg. 48, Table 8-2. If the Trust proposes that use of extraction and treatment (i.e., P&T) will require treatability testing of groundwater in order to make a remedy decision in regard to this technology, such treatability testing should be in Appendix C. Otherwise, this text should be eliminated. [Note: NDEP is aware of operational dewatering and groundwater remediation systems in the Las Vegas Valley that meet discharge requirements, so NDEP does not view this data need as a critical data need for the Groundwater CAP.]

Editorial/Typographic

The "micro" symbol µ shows up as * a number of times throughout the document.

Section 1.2.1, Site Description, this section occurs twice; delete repeat paragraph at top of page 3

Section 3.1, Shallow Groundwater. The first paragraph under this section states "*Eleven wells in the area of the former APTC facility, the Boulevard Mall, and the* ***southwestern residential area*** *are sampled semi-annually*." The reference to the "*southwestern residential area*" is unclear. At present, wells, MW-1, MW-2, MW-5, MW-6, MW-9, MW-13, MW-14, MW-17, MW-28, MW-29 are sampled semi-annually.

Section 4.0, page 13, second paragraph. Specify that the filter pack extends from 500 ft bgs **up** to 130 ft bgs.

Section 7.2, page 22. last paragraph. Typographic error. Should be MW-18, not MW-8.

Section 9.2. Noun/verb disagreement. "Aquifer characteristics such as hydraulic conductivity, transmissivity, and ion and mineral chemistry, is required to profile relevant subsurface features within the target areas."

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